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ECONOMIC INTEGRATION, SPECIALISATION AND THE LOCATION OF INDUSTRIES

A SURVEY OF THE THEORETICAL LITERATURE

European integration and global competition have an important impact on the specialisation of EU countries and on the location of industrial activities within Europe. Generally, from a policy point of view, given endowment and/or technological differences across countries, greater specialisation and division of labour will enhance efficiency and competitiveness and therefore be beneficial. However, politics has also been concerned about the possibility that locations and countries with favourable market access may benefit first and more strongly from economic integration, strengthening the imbalance between a rich core and a poor periphery.

The competitive environment of European manufacturing has been changing dramatically since the second half of the 1980s. The globalisation process, driven by abolition of trade barriers, reduced restrictions on foreign direct investments (FDI) and improvements in transport and communication has facilitated the dispersion of activities, accelerated the spread of knowledge and technology and enhanced world-wide economic integration. The emergence of Asian competitors and the opening and re-orientation of Eastern Europe have sped up this process while European integration completely abolished trade barriers between EU member states, created a single market and in its final stage set up a single currency.

While economists have given close attention to the effects of globalisation and European integration on income convergence or divergence in the EU countries, there is another important (related) issue still to be clarified: the question of the impact of these ongoing processes on industrial structures and the dispersion of industrial activities within Europe. What are the predictions on this issue from economic theory? Can we expect integration and global competition to make industrial structures across European countries more similar or to induce a trend towards higher special-

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isation? What are the conditions under which we can expect industries to become more concentrated in individual countries (the core), and when will industries disperse over all regions? Which industries will be affected most?

This article provides a survey of relevant theoretical models and their predictions on these issues¹. The two contributions to this issue by Karl Aiginger and Michael Pfaffermayr investigate it empirically by looking at the specialisation patterns of countries and examining the growth patterns of industries in EU countries.

The survey starts with a review of traditional trade theory models as well as models from the new trade theory literature which predict specialisation patterns across countries in inter- and intra-industry trade, respectively. This is followed by an overview of economic geography models, to obtain insights into the location and possible regional concentration of industries.

TRADITIONAL INTERNATIONAL TRADE THEORY MODELS

THE STATIC HECKSCHER-OHLIN AND RICARDO MODELS OF TRADE

Traditional trade theory explains trade specialisation patterns by concentrating on the unique characteristics of each country, which give rise to relative cost differences, called “comparative advantages”. These comparative advantages in turn are decisive in forming the export specialisation pattern of trading countries. *Ricardo* (1817) assumed international differences in the productivity of labour to be the sole reason for cross-country differences in comparative production costs. The “Heckscher-Ohlin theory of trade” (factor proportions theory), on the other hand, assumes that technologies are the same across countries and comparative advantages are entirely due to differences in factor endowments or the relative abundance of factors of production. Countries are expected to specialise in the export of goods whose production is intensive in factors with which they are abundantly endowed. The “generalised factor proportions theory”, in addition to capital and labour, includes human capital and other knowledge-related variables such as labour skills, R&D expenditure – variables closely linked to differences in countries’ technological capabilities, thus bringing the theory much closer to empirical reality. Subsequently there were also numerous attempts to introduce technological change into what is basically a Heckscher-

Ohlin model (*Finlay – Grubert, 1959*), but nevertheless the Heckscher-Ohlin theory remained an essentially static theory for a long time.

“MAN-MADE” COMPARATIVE ADVANTAGE, TECHNOLOGICAL CHANGE AND PRODUCT CYCLES

The first major step towards technology-oriented theories of trade emphasising technological change and the resulting pattern of trade in new products was Posner’s “technology-gap model” (*Posner, 1961*). Posner explicitly added technological progress as an independent determinant for international specialisation in trade beyond factor intensities and endowments (Heckscher-Ohlin model) and given technological differences (*Ricardo*) of the traditional trade models. International trade specialisation thus depends on the speed of innovations in one country and the speed at which they are imitated in other countries (“imitation gap”). Most importantly, in contrast to the generalised Heckscher-Ohlin model, technology is no longer regarded as an endowment, but seen as the outcome of processes of innovation, discovery, learning and imitation (“man-made”).

The technology gap model was an important precursor of the product cycle theories which incorporate the idea that products go through a “life cycle” of systematic changes in technology so that different national competitive advantages are decisive at different stages in the product life cycle: skilled labour for production and development of new products; capital intensive production processes in the “growing stage” of products; low wages and less skilled labour when the product has become mature and standardised. *Hirsch* (1967) stresses that factor endowments determine the location of production over the life cycle (allocating new products to developed countries, due to their strength in skilled labour), while *Vernon* (1966) emphasises that innovations are demand-driven, following the main arguments of *Linder* (1961), who sees innovations as a function of proximity to the market and the ease of communication. The concept of the product cycle was then formalised by *Krugman* (1979A) in a “North-South” country setting. The only source of comparative advantage of the North lies in its special ability to produce new goods (for different reasons as given by *Vernon, 1966*, and others within the concept of the product cycle), while the non-innovating South adopts and learns the new methods of production only with a time lag. This “adoption lag” in the South gives rise to trade, and the pattern of trade is solely determined by a continuing process of innovation and technology transfer to the South.

¹ An overview of existing empirical literature on these questions can be found in *Aiginger* (1999). For recent empirical results on the convergence of European industrial structures see *Aiginger et al.* (1999).

While technological change has a central role to play in determining world trade specialisation and changes in that pattern of trade over time, product cycle theories are essentially concerned with the effects, rather than causes, of innovation and technology transfer. The process of innovation and diffusion and the rates at which it occurs are taken as exogenous factors.

In the models of *Grossman – Helpman* (1991A, 1991B, 1991C) innovation is presented as an endogenous activity. The theory is based on the models of endogenous technical change by *Romer* (1990) and *Aghion – Howitt* (1990) and interprets product and process innovation as the result of deliberate, purposeful R&D carried out with profit seeking intentions, which depend on expectations of at least temporary monopoly profits until the new technology has become general public knowledge due to technological externalities. Equating innovation with the development of new products that are of higher quality than similar products on the market, the authors introduced the notion of a “quality ladder” into the literature. The model then becomes very similar to *Krugman’s* (1979A), and in a process of ongoing product upgrading and imitation the North and South are consecutively climbing the quality ladder.

Let us sum up the major predictions from the trade theory literature reviewed so far. For given differences in technology and/or endowments, the traditional Heckscher-Ohlin and Ricardo trade models forecast that the processes of European integration and globalisation lead to a higher degree of specialisation by comparative advantage. These models can best explain trade between countries at different stages of development, with different factor endowments or production technologies, trade which is characterised by an exchange of goods from different industries (inter-industry trade). In product cycle models and technology oriented North-South trade models high income countries are predicted to specialise in capital-, technology-, skill- and research-intensive industries with high levels of product and process innovations, driven by forces on the demand side and the supply side (innovation rents, capacity to make use of technological opportunities). In industries where product differentiation is important, high income countries specialise in products of the upper quality segment. Trade is then characterised by an exchange of goods that belong to the same industry but are of different quality (intra-industry trade in vertically differentiated goods).

NEW TRADE THEORY AND INTRA-INDUSTRY TRADE (IIT)

Comparative advantage, while relevant, is insufficient as the only explanation of specialisation, as the bulk of inter-

national trade actually takes place among industrialised countries despite the fact that these countries share very similar factor endowments and production technologies. In addition, this trade between industrialised countries may take the form of intra-industry trade (IIT) in horizontally differentiated goods, i.e., an exchange of different varieties of a good that fall into the same product category and are of the same quality. This phenomenon is explained by the new trade theory, which stresses scale economies, product differentiation (preference variety) and imperfect competition.

First attempts to introduce increasing returns to scale in models of trade maintained the assumption of perfect competition by relying on the concept of Marshallian external economies. In the external economy model, costs depend on location: *ceteris paribus*, the larger the size of the local industry, the lower will be the costs. While each firm behaves as though it is subject to constant returns to scale, scale economies become effective at the industry (branch) level and form the basis for regional concentration of industries. Some of the more recent contributions to this literature include *Panagariya* (1980, 1981, 1986) and *Ethier* (1982).

A second category of new trade theory models is based on economies of scale that are internal to the firms and allow for monopolistic competition. The most influential approach to modelling monopolistic competition is based on the work of *Dixit – Stiglitz* (1977) and has been introduced to international trade theory by *Krugman* (1979B)². The key assumptions in such a framework are: a perfect symmetry across varieties in production as well as consumption; each consumer derives utility from product variety, and for given income utility increases with the number of varieties (“love of variety” approach); the production of each variety is subject to internal economies of scale; free entry or exit of firms drives profits towards zero.

In the *Krugman* (1979B) model, trade becomes a way of extending the market and of allowing the exploitation of scale economies; and intra-industry trade is the natural outcome regardless of international differences in technologies, factor endowments or tastes. Furthermore, although the model is able to predict the volume of trade, the direction of trade and the production structure in these kinds of models can be explained only if they are augmented by endowment and/or technology differences or if transportation costs are introduced making it more profitable to locate increasing return activities in the location with the larger market. The latter is an argument similar to

² Another approach draws on the work of *Lancaster* (1979, 1980) and is developed by *Helpman* (1981). It is based on a “most preferred variety” utility function; see also *Helpman – Krugman* (1985).

that made by *Linder* (1961) who hypothesised that countries are likely to export goods that are in greater demand at home. In the more recent literature this has been dubbed as the “home market effect” or “home market bias in exports” (*Krugman*, 1980, *Helpman – Krugman*, 1985). A strong example of home market effects is given by *Krugman* (1980) who combined an increasing returns production technology with transportation costs. It should be noted that it is the presence of transportation costs which plays the most crucial role in obtaining home market effects. At the same time the 1980 model is an interesting initial application of the *Krugman* (1979B) model in the area of economic geography, and we will return to this model later in our discussion. *Ethier* (1982) shifts the interest to the input side. Intermediate inputs are produced with economies of scale, and a greater variety of components yields economies of specialisation. Trade provides each country with access to the components of the others, which gives rise to “international economies of scale” and leads to intra-industry trade in inputs.

Intra-industry trade is in general predicted to rise as countries become more similar. However, one of the most important distinctions made in the various models explaining intra-industry trade is that between horizontal and vertical product differentiation³. The implications of models of vertical product differentiation are quite different from those of models that incorporate horizontal product differentiation as they provide an explanation of intra-industry trade in a quasi Heckscher-Ohlin setting, predicting a positive relationship between the difference in factor endowments and vertical intra-industry trade (*Falvey*, 1981, *Falvey – Kierzkowski*, 1985). The central assumption of the respective models is that a higher capital-labour ratio results in the production of higher quality. From this it follows that capital-abundant, rich countries export relatively high quality products, while less developed, labour-abundant countries export relatively low quality products – a prediction that has also been derived from technology oriented theories.

ECONOMIC GEOGRAPHY

In addition to traditional trade theory and new trade theory models, economic geography models form a third class whose most distinctive element is the interaction of increasing returns with transportation costs across countries (or regions). In such a world increasing return activi-

³ Horizontal differentiation refers to different varieties of a product that are of similar quality (different colour and design of shoes of similar quality). Vertical differentiation refers to different varieties that are of different qualities (leather shoes, plastic shoes).

ties are predicted to be located in the larger market, giving rise to a “home-market effect”. Market size then becomes the basis for trade and differences in the production structure. It should be noted that without transportation costs in an increasing returns model specialisation patterns would be indeterminate, as is the case in the new trade theory models reviewed before.

Home market effects also produce results that are fundamentally different from models of comparative advantage. In a comparative advantage model, *ceteris paribus*, unusually strong demand for a class of goods will turn those goods into importables. Transportation costs may lower the trade volume, but will never lead to the export of the product as in a world of increasing returns to scale (*Davis – Weinstein*, 1996).

Krugman (1980) first applied the framework given in *Krugman* (1979A) in the area of economic geography. He models two countries which are of equal size and equally endowed in terms of the (only) factor labour. However, consumers in each country have different tastes with respect to two groups of products, but one country is the mirror image of the other.

Krugman then arrives at the following results: first, if countries are identical in all respects except size, the country which has the larger domestic market will have higher wages. Secondly, under autarky, the country with the larger home market for one product will produce a larger variety of this product and will be a net exporter of that product when trade opens (home market bias in exports). *Krugman* also shows that if two countries have sufficiently dissimilar tastes each will completely specialise in the industry in which it has a home demand bias. Also, if the assumption of equal country size is relaxed and consumption patterns across countries are the same, the larger country will be the net exporter of products whose production involves economies of scale.

The *Krugman* (1980) framework represents one of the early economic geography models in which location patterns emerging in a process of economic integration are driven by exogenous differences in market size (see also *Helpman – Krugman*, 1985, *Krugman – Venables*, 1990). Within this framework it is not possible to explain why countries which are very similar also with respect to their size (or market access) can diverge in production structures. More recent advances in economic geography have combined the home market effect with “cumulative or circular causation in location decisions of firms and consumers/workers” and formalised forward-backward linkage mechanisms giving rise to agglomeration economies: if economic activity is already concentrated to a certain extent in one place this creates a favourable economic en-

vironment that supports further concentration. Regional concentration becomes a self-reinforcing process. History may thus play a role, since cumulative and circular causation can maintain and magnify past specialisation patterns.

This cumulative process builds on the existence of externalities, which according to *Marshall* (1920) can arise because of three forces: knowledge spill-overs (technological spill-overs), availability of specialised skills, and forward and backward linkages associated with large markets. While all three are important, the new economic geography models explicitly focus on the third, linkages.

Krugman (1991A, 1991B) provided the basic framework with international labour mobility as the driving force for agglomeration (demand linkage) in interaction with increasing returns and trade costs: locations close to large markets pay higher real wages and consequently attract more labour. This enlarges the market further and causes positive demand effects and backward linkages as a greater number of consumers makes the core even more attractive for firms and causes a concentration of economic activity. Another set of models stresses vertical linkages between firms as giving rise to cost and demand linkages and agglomeration forces (*Krugman – Venables*, 1995, *Venables*, 1996, *Puga*, 1999): the downstream firm forms the market for the upstream firm, and with transportation costs, market access considerations draw the upstream firm to locations where there are many downstream firms. This gives rise to a demand linkage (for *Krugman*, demand came only from consumers). On the other hand, with transportation costs incurred in shipping goods, downstream costs depend on the location of upstream firms. The closer a downstream firm locates to the market where there are many upstream firms, the more will it save in transportation costs. Demand and cost linkages of vertically integrated firms thus constitute the driving force for the agglomeration of activities.

On the other hand, dispersion forces are essential to any model of economic geography. Various sources of dispersion forces have been used in the literature: geographical dispersion of demand from immobile agricultural workers (*Krugman*, 1991A, 1991B), from immobile consumers (*Krugman – Venables*, 1995, 1996); non-traded goods (*Helpman*, 1997); immobile factors of production; congestion externalities (*Ricci*, 1999), land rent (*Elizondo – Krugman*, 1996); local public expenditure (*Trifonetti*, 1997).

Most importantly, the relative strength of agglomeration and dispersion forces is shown to be affected by transportation costs. One recurrent feature in these models is that there is a U-shaped relationship between increasing

economic integration (decreasing transportation costs) and the degree of geographical concentration of production so that there may be two phases: a first one in which agglomeration increases as trade costs decrease to an intermediate level, and a second one in which diseconomies of agglomeration (such as increasing wages or congestion externalities) combined with ever lower transportation costs lead to dispersion. As *Krugman – Venables* (1990) point out, the critical assumption for this U-shaped relationship between transportation costs and the geographic concentration of industry is that relative factor prices diverge. Anything that impedes the emergence of such differences (for example: internationally mobile labour or capital) will reinforce the tendency to concentrate production in the larger country or the core. Labour mobility, for example, would reinforce centripetal tendencies associated with integration, because it reduces the magnitude of wage differentials and, as more labour migrates to the core, accentuates market size differences between the centre and the periphery.

Intuitively, when trade barriers are initially very high and then reduced, production will first move to the larger country because of cost advantages enjoyed when a product of increasing returns is produced in the larger market, given high transportation costs. As the size of the industry in the core increases, this will give rise to regional wage differentials because factor market competition takes over (upward sloping labour supply schedules), but also (with regard to real wages) partly because of differences in price indices as transportation costs are incurred for different volumes of goods in the two locations. The smaller (peripheral) country will then have lower wages. If factors were mobile between countries, this accompanying rise in factor prices would simply give additional momentum to the concentration of industry in the larger market by inducing migration. But if there are some immobile factors instead which are important for production, or non-tradeable goods that are particularly important for consumption (e.g., housing) they will act as dispersion forces and bring regional convergence in terms of production structures as integration goes far enough.

AGGLOMERATION ECONOMIES AND THE REGIONAL PATTERN OF SPECIALISATION

When it comes to specialisation, most models of economic geography usually predict that, due to agglomeration forces, the core region specialises in increasing returns to scale (IRS) activities while constant returns to scale (CRS) activities move to the periphery, yet nothing is said about specialisation across regions within the IRS industry. If differences in factor endowments of countries are taken

into account as is done by, e.g., *Krugman – Venables* (1990), these models based on one CRS activity and one IRS activity predict that if the large country also happens to have a comparative advantage in the IRS industry, then the centripetal forces in the model will be reinforced. If the small country happens to have a comparative advantage in producing differentiated goods, then in the early stages of trade liberalisation firms will start to relocate to the larger market even though this goes against the direction of the trade flow predicted on the basis of relative factor endowments. However, due to lower wages in the peripheral country, with sufficiently low trade barriers, manufacturing output in the periphery will rise continuously.

But if European integration induces agglomeration, which would be the activities within the IRS industry that the core is more likely to attract, and which activities is the periphery more likely to lose? Only some papers have attempted to integrate economic geography models with traditional trade theory based on comparative advantage and investigated the relationship between agglomeration and specialisation *within* the IRS activity.

Amiti (1998) directly examines how, under otherwise equal circumstances, the size of a country can influence specialisation patterns when industries are allowed to differ in terms of factor intensities, trade costs and demand elasticities. She specifies conditions under which the larger country could specialise in the labour intensive goods subject to higher transportation costs at high levels of these costs and become a net exporter of capital intensive goods at low levels of trade costs. Since workers are immobile and firms do not use intermediate inputs, *Amiti's* model does not take into account endogenous agglomeration effects. Therefore this framework does not allow investigating the relationship between agglomeration and specialisation within the IRS sector.

Krugman – Venables (1996) show how specialisation can be induced by sector-specific agglomeration forces, when input-output linkages are stronger within industries than between industries with each of the countries (assumed to be symmetric) specialising in a single industry⁴.

Venables (1998) considers a continuum of industries which differ in relative productivities due to Ricardian technical differences between countries. He shows that the resulting pattern of production is not unique and not necessarily in line with comparative advantage.

Ricci (1999) presents a model in which an increase in country size, inducing the agglomeration of increasing re-

turns activities, reduces the specialisation of that country in the comparative advantage sector within the IRS sector. He also shows that lowering trade costs can move industries into the smaller country, when the smaller country enjoys higher productivity. *Bruelhart* (1995) investigates the relationship between liberalisation, increasing returns and intra-industry trade. He concludes that intra-industry trade will decline with progressing integration. Furthermore, if there is a time lag between trade liberalisation and the relocation of production there will be an initial surge of IIT followed by a decline.

Summing up, the major characteristics and predictions from economic geography models are as follows: economic geography models focus on the forces of agglomeration and dispersion. Economies of scale are as essential to these models as are transportation costs. Their main focus is on regions or locations, not countries, on the share of production, not trade, and finally, on differences in market size and demand structures. Economic geography highlights the possibility that locations and countries with optimal market access may profit first and more strongly from economic integration. In the presence of transportation costs, industries for which increasing returns to scale are important locate near the largest market. These are likely to produce technologically advanced, innovative, new products which involve a high share of fixed costs due, e.g., to R&D investments. Through agglomeration economies, the geographic concentration of economic activity can then become a self-reinforcing process. The periphery specialises in low wage industries and mature products, in industries with less product differentiation and limited spill-overs. Eventually this process of agglomeration is forecast to reverse, however, if factor prices rise faster in the centre, if diseconomies of agglomeration emerge and if economic integration reaches a sufficiently low level to make a given cost difference between the core and the periphery more decisive.

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⁴ If instead it is assumed that inter-industry linkages are more important, each location will always have some of each industry, as firms always derive more advantages from proximity to firms in the other industry.

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Economic Integration, Specialisation and the Location of Industries

A Survey of the Theoretical Literature – Summary

European integration and global competition can be expected to have important consequences on the industrial specialisation of individual EU countries as well as the location of industrial activities within Europe. Generally, from a policy point of view, for given endowment and/or technological differences across countries, greater specialisation and a higher degree of division of labour will enhance efficiency and competitiveness and therefore be beneficial. On the other hand, specialisation in narrow product groups may increase the exposure to fluctuations of demand for individual countries. Another policy concern has been the possibility that locations and countries with optimal market access may benefit earlier and at a greater rate from economic integration, strengthening the imbalance between a rich core and a poor periphery. The article gives a survey of the most important predictions of economic theory on these issues which can be summarised as follows:

For given endowment and/or productivity differences across EU countries, intensified integration and global competition are predicted to increase specialisation according to comparative advantage. The higher income countries are predicted to specialise in capital-, technology-, skill- and research-intensive industries. If endowments and productivities converge – as is a natural prediction for a single market with perfect factor mobility – and industries are characterised by constant returns to scale, specialisation is forecast to decrease.

High income countries will concentrate on industries with high levels of product and process innovation, driven by forces on the demand side (new products and greater

variety are demanded) and the supply side (innovation rents and the capacity to make use of technological opportunities). In industries where product differentiation is important, countries specialise in products in the upper quality segment. Countries with similar incomes, factor endowments and technologies engage in intra-industry trade.

Economic geography models focus on the forces of agglomeration and dispersion. Economies of scale are as essential to these models as are transportation costs. Their main focus is on regions or locations, not countries, on the share of production, not trade, and finally, on differences in market size and demand structures. Economic geography highlights the possibility that locations and countries with optimal market access may benefit first and more strongly from economic integration. In the presence of transportation costs, industries for which increasing returns to scale are important locate near the largest market. These are likely to produce technologically advanced, innovative, new products which involve a high share of fixed costs due, e.g., to R&D investments. Through agglomeration economies, the geographic concentration of economic activity can then become a self-reinforcing process. The periphery specialises in low wage industries and mature products, in industries with less product differentiation and limited spillovers. Eventually this process of agglomeration is forecast to reverse, however, if factor prices rise faster in the centre, if diseconomies of agglomeration emerge and if economic integration reaches a sufficiently low level to make a given cost difference between the core and the periphery more decisive.